

PCT COOPERATION TREATY

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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 17 March 2000 (17.03.00)	Applicant's or agent's file reference MJ/TM/STS.23
International application No. PCT/GB99/02368	Priority date (day/month/year) 23 July 1998 (23.07.98)
International filing date (day/month/year) 23 July 1999 (23.07.99)	
Applicant BHARDWAJ, Jyoti, Kiron	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

22 February 2000 (22.02.00)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer S. Mafla Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference MJ/TM/STS.23	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 99/ 02368	International filing date (day/month/year) 23/07/1999	(Earliest) Priority Date (day/month/year) 23/07/1998
Applicant SURFACE TECHNOLOGY SYSTEMS LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 5 sheets.
☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☒ Unity of invention is lacking (see Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02368

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01L21/306 H01L21/311 H01L21/3213

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 529 475 A (OKANO HARUO ET AL) 16 July 1985 (1985-07-16)	1,2,4-6, 9-11, 14-20, 25,27, 31-33
Y	column 2, line 52 -column 7, line 61; figures 2,3,8	26
X	--- EP 0 562 848 A (HITACHI LTD) 29 September 1993 (1993-09-29)	1-4, 7-10,13, 18-20, 25, 27-29, 31-33
A	the whole document --- -/-	21-24

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

21 October 1999

Date of mailing of the international search report

10.05.00

Name and mailing address of the ISA

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Authorized officer

Micke, K

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 99/02368

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-33

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

1. Claims: 1-33

Method and apparatus for performing high rate anisotropic etching of different materials.

2. Claims: 34-37

Method and apparatus for delivering a condensable vapour into an etch chamber.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/02368

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4529475 A	16-07-1985	JP 1895081 C	26-12-1994
		JP 6022212 B	23-03-1994
		JP 59220925 A	12-12-1984
		DE 3475990 D	09-02-1989
		EP 0127188 A	05-12-1984
EP 0562848 A	29-09-1993	JP 5275402 A	22-10-1993
EP 0567063 A	27-10-1993	US 5205901 A	27-04-1993
		US 5238529 A	24-08-1993
		US 5238530 A	24-08-1993
		US 5201989 A	13-04-1993
		DE 69317141 D	09-04-1998
		DE 69317141 T	25-06-1998
		JP 6049663 A	22-02-1994
		US 5374330 A	20-12-1994
		JP 6049662 A	22-02-1994
		JP 6122980 A	06-05-1994
		JP 6049664 A	22-02-1994
		US 5312516 A	17-05-1994
EP 0595053 A	04-05-1994	JP 6204204 A	22-07-1994
		MX 9305898 A	31-01-1995
		US 5460687 A	24-10-1995
DE 4241045 C	26-05-1994	WO 9414187 A	23-06-1994
		EP 0625285 A	23-11-1994
		JP 7503815 T	20-04-1995
		US 5501893 A	26-03-1996
US 5221366 A	22-06-1993	US 5009725 A	23-04-1991
		JP 2068808 C	10-07-1996
		JP 5136107 A	01-06-1993
		JP 7093289 B	09-10-1995
		US 5062902 A	05-11-1991
		US 5094701 A	10-03-1992
US 4749440 A	07-06-1988	AT 113757 T	15-11-1994
		CA 1275376 A	23-10-1990
		CN 1005803 B	15-11-1989
		DE 3650127 D	08-12-1994
		DE 3650127 T	24-05-1995
		EP 0235256 A	09-09-1987
		JP 6026206 B	06-04-1994
		JP 62502930 T	19-11-1987
		KR 9104039 B	22-06-1991
		WO 8701508 A	12-03-1987

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/02368

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 567 063 A (TEXAS INSTRUMENTS INC) 27 October 1993 (1993-10-27) the whole document ---	1,2,4-8, 14,18-20
X	EP 0 595 053 A (TEXAS INSTRUMENTS INC) 4 May 1994 (1994-05-04) the whole document ---	1,2,4,8, 11,14, 18-20
X	DE 42 41 045 C (BOSCH GMBH ROBERT) 26 May 1994 (1994-05-26) cited in the application the whole document ---	27,29, 30,32,33
Y	US 5 221 366 A (IVANKOVITS JOHN C ET AL) 22 June 1993 (1993-06-22) cited in the application column 1, line 55 - line 66 column 3, line 49 - line 57 ---	26
A	US 4 749 440 A (BLACKWOOD ROBERT S ET AL) 7 June 1988 (1988-06-07) cited in the application column 5, line 39 -column 12, line 45 column 14, line 13 - line 16 -----	5-8,26

PATENT COOPERATION TREATY

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REC'D 26 OCT 2000

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference MJ/CS/STS.23	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB99/02368	International filing date (day/month/year) 23/07/1999	Priority date (day/month/year) 23/07/1998
International Patent Classification (IPC) or national classification and IPC H01L21/00		
Applicant SURFACE TECHNOLOGY SYSTEMS LIMITED et al.		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 9 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none">I <input checked="" type="checkbox"/> Basis of the reportII <input type="checkbox"/> PriorityIII <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicabilityIV <input type="checkbox"/> Lack of unity of inventionV <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statementVI <input type="checkbox"/> Certain documents citedVII <input checked="" type="checkbox"/> Certain defects in the international applicationVIII <input checked="" type="checkbox"/> Certain observations on the international application		
Date of submission of the demand 22/02/2000	Date of completion of this report 24.10.2000	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Götz, A Telephone No. +49 89 2399 2498 	

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/02368

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-26 as originally filed

Claims, No.:

1-40 as originally filed

Drawings, sheets:

1/6-6/6 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

- ☐ the entire international application.
- ☒ claims Nos. 34-40.

because:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/02368

- ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

- ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

- ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

- ☒ no international search report has been established for the said claims Nos. 34-40.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims 5-26
	No: Claims 1-4, 27-33
Inventive step (IS)	Yes: Claims
	No: Claims 1-33
Industrial applicability (IA)	Yes: Claims 1-33
	No: Claims

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB99/02368

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/02368

1 Reference is made to the following documents:

- D1: US-A-4 529 475 (OKANO HARUO ET AL) 16 July 1985 (1985-07-16)
D2: DE 42 41 045 C (BOSCH GMBH ROBERT) 26 May 1994 (1994-05-26) cited
in the application
D3: EP-A-0 562 848 (HITACHI LTD) 29 September 1993 (1993-09-29)
D4: US-A-5 221 366 (ROBERTS DAVID A ET AL) 22 June 1993 (1993-06-22)
cited in the application.

Re Item V

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or
industrial applicability; citations and explanations supporting such statement**

2 The subject-matter of independent claim 1 of the present application is not new in
the sense of Article 33(2) PCT.

The document D1 discloses (the references in parentheses applying to this
document):

A method of treating a substrate material or film present on the material surface
comprising cyclically performing the following steps (cf. column 6, lines 35-45):

- a) etching the material or film (cf. column 4, lines 46-51);
- b) depositing or forming a passivation layer on the surfaces of an etched feature
(cf. column 4, lines 51-61);
- c) selectively removing the passivation layer from the etched feature in order that
the etching proceeds in a direction substantially perpendicular to the material or
film surface (cf. column 4, lines 61-62),
wherein at least one of step a) or b) is performed in the absence of a plasma (cf.
column 2, lines 52-53).

It is noted that in the present application it seems essential that the steps a)-c) are
performed cyclically and repeatedly (cf. e.g. Figs. 8 of the present application) and
that after each cycle the features are etched deeper. This is however not defined
with the term "cyclically" alone. In D1 the steps are also performed "cyclically"
(even though the steps of each cycle are performed at a different position). Also a
"cyclically" performed set of steps includes performing the "cycle" only once and
not repeatedly. It seems that an accordingly clarified claim 1 would be novel
against D1.

- 3 For the assessment of inventive step (Article 33(3) PCT) a claim 1 amended according to the above mentioned comments and which is novel against D1 is assumed. The document D2 is regarded as being the closest prior art to the subject-matter of such a claim 1, and discloses all the features of claim 1 with the exception that in D2 steps a) and b) are performed in the presence of a plasma while claim 1 defines that one of step a) or b) is performed at the absence of a plasma. This feature covers three alternative methods, namely:
- i) step a) is performed in the absence of a plasma and step b) in the presence of a plasma
 - ii) step b) is performed in the absence of a plasma and step a) in the presence of a plasma; and
 - iii) both step a) and step b) are performed in the absence of a plasma.
- When the method according to alternative ii) is compared to the method known from D2 the difference is that in D2 the passivation layer is deposited in the presence of a plasma and in claim 1 in the absence of a plasma. Whether the passivation layer is formed in the presence or the absence of a plasma is simply a choice from a number of equally like alternatives. Hence, because of the alternative ii) claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT).
- It appears that an amended claim 1 without the alternative ii) might be considered inventive given the advantages as mentioned in the description of the present application on page 4.

- 4 The subject-matter of independent claim 27 of the present application is not new in the sense of Article 33(2) PCT. The document D2 discloses (the references in parentheses applying to this document):
- An apparatus comprising a chamber (Fig. 1, reference sign 10) having a chemical inlet (Fig. 1, reference sign 22) and a chemical outlet (not explicitly shown; it is however implicitly clear that a chemical outlet must exist) in which is positioned a support (Fig. 1, reference sign 12) for receiving a substrate (Fig. 1, reference sign 18), the apparatus further comprising means for etching a substrate material or a film present on the material surface with one or more appropriate chemicals (cf. column 4, lines 44-49), means for depositing a passivation layer on the surfaces of an etched feature (cf. column 5, lines 9-22), and means for selectively removing the passivation layer from the etched feature in order that the etching proceeds in

a direction substantially perpendicular to the material or film surface (cf. column 5, lines 23-49).

- 5 To independent claim 33 applies the same reasoning as to claim 27, i.e. the claim is not new against D2 (cf. also Item VIII of this communication).
- 6 It is pointed out that the subject-matter of independent claims 27 and 33 is neither new against document D1 nor against D3.
- 7 Dependent claims 2-26 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty (Article 33(2) PCT) and/or inventive step (Article 33(3) PCT), the reasons being as follows:
The features of dependent claims 2, 4-6, 9-11, 14-20 and 25 are known from D1.
The features of dependent claims 3, 7, 8 and 13 are known from D3.
The feature of etching Au or Pt with aqua regia (claim 12) cannot be considered inventive, since aqua regia is a well known etchant for Au and Pt.
In D1 a plasma is used for the surface irradiation (cf. column 7, lines 28-31). The further features of claims 21 to 24 are merely choices from several straightforward possibilities from which the skilled person would select, in accordance with circumstances and without the exercise of inventive skill (e.g. an ion energy of greater than 10eV is just a typical range).
The etchant materials of claim 26 are known from D4.
- 8 Dependent claims 28-32 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step, the reasons being as follows:
 - 8.1 Claim 28 is not new (Article 33(2) PCT) since in D2 the support is in the form of a first electrode (Fig. 1, reference sign 12).
 - 8.2 Claim 29 is not new (Article 33(2) PCT) since the apparatus of D2 comprises means for providing RF energy or microwave energy to a plasma in the chamber (cf. column 4, lines 50-62).

- 8.3 Claim 30 is not new (Article 33(2) PCT) since the apparatus of D2 comprises means for providing an electrical bias on to the support to accelerate ions onto the substrate (cf. column 4, lines 57-62).
- 8.4 Claim 31 is not new (Article 33(2) PCT) since the apparatus of D2 comprises means for controlling the substrate temperature (cf. column 4, lines 10-12). The other optional technical features of claim 31 are trivial features, since chambers with means for providing radiation energy and for rotation are commonly used in the art.
- 8.5 Claim 32 is not new (Article 33(2) PCT) since all the mentioned means are associated with a single chamber in D2.

Re Item VII

Certain defects in the international application

- 9 The units of measure Torr and mTorr employed in the description are not additionally expressed in terms of the units stipulated by Rule 10.1(a) PCT.
- 10 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 and D3 is not mentioned in the description, nor are these documents identified therein.
- 11 Independent claim 1 is not in the two-part form in accordance with Rule 6.3(b) PCT.
- 12 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Re Item VIII

Certain observations on the international application

- 13 Although claims 27 and 33 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is

sought and in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness. Hence, claims 27 and 33 do not meet the requirements of Article 6 PCT.

14 Claim 1 does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claim attempts to define the subject-matter in terms of the result to be achieved ("... in order that the etching proceeds in a direction ... perpendicular to ...") which merely amounts to a statement of the underlying problem. The technical features necessary for achieving this result (e.g. where the passivation layer is removed) should be added.

15 It is clear from the description that the feature that at the beginning of the process the material surface has a mask pattern defined thereon is essential to the definition of the invention. It appears impossible to achieve an anisotropic etch without the mask pattern.

Since independent claim 1 does not contain this feature it does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.